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LEAFHOPPER CONTROL WITH DDT IN RELATION TO LENGTH OF SEASON, QUALITY AND YIELD OF SEVENTEEN POTATO VARIETIES

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The potato leafhopper, *Empoasca fabae* Harris, is undoubtedly the worst pest of potatoes in Illinois. Leafhopper feeding causes premature death of vines and a reduction in quality (starch content) and yield. Under these conditions potato varieties are extremely difficult to evaluate for qualities other than leafhopper resistance. Furthermore, the degree of leafhopper resistance, in itself, to say nothing of other characteristics cannot be determined with any exactitude unless perfect or near-perfect control of these insects can be achieved for comparative purposes. Prior to the advent of DDT, such control was difficult if not impossible. With DDT almost perfect control can be obtained (3, 6, 18, 19, 20) without

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the complications of insecticidal phytotoxicity (5) and infestations can be reduced sufficiently to illustrate the extremely marked effects of low leafhopper populations on yields (20).

Potato varieties vary widely in their susceptibility to hopperburn (1, 2, 10, 12, 13, 14), ranging from the very susceptible Bliss Triumph and Pontiac to resistant Sequoia. Investigators are not in agreement, however, as to why some varieties are more severely damaged than others. Early varieties have been claimed to be more susceptible than later kinds, but Allen *et al* (2) state that relative earliness or lateness is not the prime factor. In their experiments the early varieties Bliss Triumph and Warba proved more attractive throughout the season than the later varieties, Katahdin and Houma. Sleesman and Stevenson (14) point out that the correlation between earliness and susceptibility may be a pseudo-relationship since it is difficult to distinguish between maturity necrosis and that caused by leafhoppers. Allen and Rieman (1) were of the opinion that the leafhopper tolerance exhibited by Katahdin and Houma might account in part for the heat and drought resistance attributed to these varieties by several investigators.

The differential response to leafhopper control has been reported for several varieties but other important and coincidental yield-depressing factors such as phytotoxicity of insecticides and fungicides, and damage from diseases have been difficult to measure. Sleesman and Bushnell (13) used Bordeaux mixture on 13 varieties and found that those with hopperburn ratings between Sequoia (none - light) and Bliss Triumph (severe) generally responded with uniform yield increases. However, Bonde *et al* (4) and Horsfall and Turner (7) have pointed out that Bordeaux mixture is phytotoxic under some conditions and may reduce yields in the absence of pests. The dwarfing effect of Bordeaux mixture is often masked by disease and insect pest control, and yield reductions from its use may amount to as much as 13 per cent in Cobbler (7). Willson and Sleesman (19) by using a combined spray of DDT and a fixed copper were able to reduce leafhopper damage to insignificance on 10 varieties. Nymphal populations which averaged less than one individual per leaf on unsprayed plants were accompanied by "comparatively" severe blight infection. Thus the two factors—insects and a defoliation disease—could not be evaluated separately.

Potato virus diseases have been overlooked or their incidence not reported in practically all investigations concerning leafhopper susceptibility and varietal response to leafhopper control. Yet it is not uncommon to find 10 per cent or more leafroll in certified stocks, particularly in susceptible varieties such as Chippewa. The yield-depressing effect of such

virus diseases as leafroll and spindle tuber is well known. Leafroll in particular causes a reduction in both number and size of tubers. Tuthill and Decker (16) calculated that losses from leafroll in Chippewa ranged from 2.8 per cent for 10 per cent leafroll to 40.7 per cent for 100 per cent infection; and yield reductions in Cobbler from 3.7 to 53.0 per cent, respectively. LeClerg *et al* (9) reported no difference in per cent yield reduction from leafroll between Katahdin and Cobbler over a period of several years and in various states. Per cent losses in yield for the two varieties ranged from 3.2 with 4 per cent leafroll to 57.1 with 100 per cent infection. They state further that the reduction in yield from 8 per cent or less leafroll is relatively small from the standpoint of the commercial grower. Kirkpatrick and Blodgett (8), using data from yields of Chippewa, Cobbler and Green Mountain as well as data from Tuthill and Decker, derived an equation by which it was claimed the yield potential of any leafroll-free variety, strain or plot could be estimated from the yield of leafroll contaminated stock. Sleesman and Stevenson (14) considered the detection of rugose mosaic, leafroll and spindle tuber of importance in breeding for leafhopper resistance since plants affected with these diseases suffer more from leafhopper feeding than healthy ones.

The bases for measuring varietal responses to leafhopper control have been adult and nymphal populations, severity of hopperburn and yield increases, with but little emphasis on increase in starch content of the tubers. Sleesman and Wilson (15) found a high negative correlation between nymphal populations and yield, between dead foliage and yield, and a high positive correlation between nymphs and dead foliage. Apple and Arnold (3) reported a highly significant correlation coefficient of —.87 between nymphal populations and specific gravity of the tubers. They used pounds of starch per acre as a criterion for measuring potato leafhopper control with 11 different insecticides.

The striking increases in length of season among potato varieties due to leafhopper control with DDT has not been stressed thus far. Yet the widespread adoption of DDT for use on potatoes means that revisions may be necessary in "days-to-maturity" for most varieties where leafhoppers are an annual problem. Length-of-season increases, resulting from the application of DDT, might well be of some importance to potato growers who must place their crop on an early market.

Experiments were conducted in 1946 to determine the effect of leafhopper control with DDT—in the absence of fungicides—on length of season, quality and yield of several old and certain relatively new potato varieties. An attempt was made to eliminate or to record and evaluate, where possible, factors other than leafhopper feeding that might depress

yields. It was hoped that information from these tests might indicate the relative susceptibility of some of the newer as well as older varieties to leafhopper feeding under Illinois conditions, and those varieties on which DDT could be used most profitably from the standpoint of improving both quality and yield. Although these experiments represent only one year's work, it is hoped that the results will illustrate some of the difficulties involved in measuring varietal response to leafhopper control.

The decision to attempt an evaluation of varieties in the absence of fungicides, involving a risk of infection with foliage diseases, was based on two major premises, namely, incidental leafhopper control with fungicides and phytotoxicity from these materials. Although Heuberger and Stearns (6) showed that Zerlate and Compound A have no additive effect on leafhopper control when combined with DDT, their data and those of Wilson and Sleesman (18) demonstrate that many fungicides when used alone on potatoes provide some measure of leafhopper control. Therefore, a true measure of varietal response to an insecticide such as DDT would be difficult, were a fungicide with some insecticidal properties applied to plots not receiving DDT. From the standpoint of phytotoxicity almost any fungicide may conceivably have a depressing effect on vine growth and tuber development which may not be readily measured or even detected.

Materials and Methods

Seventeen varieties ranging in season from very early to very late were chosen. All were northern-grown certified stock with the exception of Pawnee which was War-approved. Two plantings were made, one at Urbana, Illinois on the 13th of April containing mostly early to midseason varieties and the other at Des Plaines (Cook County) on the 23d of May consisting largely of late kinds. A few varieties which had not been tested over a long enough period of time in Illinois to determine their characteristics or adaptability were planted at both locations. Each of the two plantings was made up of two separate but adjoining blocks[1] containing three replicates of 20 hills for each variety. The varieties were arranged so that no variety was planted alongside another more than once in each block. The arrangement of varieties in each of the two blocks, however, was identical. One of the two blocks was dusted with DDT, and the other left undusted. Three applications of a 3 per cent DDT dust were made at Urbana and four dustings with 5 per cent DDT were applied at Des Plaines. The block to be dusted was chosen with re-

[1]One problem in using DDT for which there seems to be no easy solution is the matter of drift (17) which largely precludes the possibility of setting up randomized blocks or Latin-Squares.

spect to the direction of prevailing winds so that a minimum of DDT would drift into the undusted block. No attempt was made to follow a predetermined schedule or to hold the number of applications within the limits of commercial practice, but rather to put on a number sufficient to obtain maximum leafhopper control.

Leafhopper nymphs were counted on one median leaf on each of five plants selected at random near the center of each plot. Counts were made at approximately seven-day intervals until within three weeks of harvest (Urbana) or until populations had diminished to insignificant numbers (Des Plaines). Flea beetles were never present in sufficient numbers to warrant taking population or feeding records. Severity of hopperburn was recorded several times during the season in both plantings. All plots were examined for the presence of virus and other diseases at approximately three-week intervals.

Harvesting of each variety was done within two or three weeks after vine maturation. The vines were considered mature when 90 per cent of the foliage was dead. All tubers measuring over 1 inch in diameter were counted to determine tuber set per hill. Specific gravity determinations were made on 10-pound samples taken at random from each block. The per cent of starch was calculated from the equation of Von Scheele *et al* (11). The pounds of starch per acre were obtained by multiplying pounds of tubers to the acre by per cent starch.

Weather Conditions

Weather at Urbana was extremely favorable for the growth of early-planted potatoes with the exception of the period between planting and emergence during which rainfall totaled 4.79 inches. Rainfall from emergence to harvest amounted to slightly more than 19 inches which was rather uniformly distributed throughout the growing season. The temperatures were normal for the season. Weather at Des Plaines was decidedly unfavorable for good growth of potatoes. Near-drought conditions prevailed with rainfall during the growing season totaling only 9.1 inches of which 6 inches fell on three days. The months of July, August and September were well below normal in rainfall and, as would be expected, above normal in sunshine. However, temperatures were only slightly above normal.

Results

Leafhopper Populations. Leafhopper nymphs increased in the undusted plots at Urbana (table 1) as the season progressed but declined at Des Plaines (table 2) These trends are found very often in early and late-planted potatoes in Illinois. Efforts to prevent leafhopper increases

TABLE 1.—*Leafhopper populations in relation to varieties, hopperburn and yield increases from control with DDT. Planted at Urbana on April 13—Average of 3 plots.*

Variety	Treatment[1]	Leafhopper Nymphs per Leaves June 16[2]	June 24	July 1	July 8	Mean	Hopper-burn[4]	Per cent Increase in Yield from DDT
Triumph	No DDT	28.7	24.7	58.3	72.3	46.0	Severe	203
	DDT		0	0	0		None	
Pontiac	No DDT	19.3	12.3	53.7	56.0	35.3	Severe	185
	DDT		0	0	0		None	
Cobbler	No DDT	7.3	11.3	57.3	58.7	33.7	Moderate	122
	DDT		0	0	0		None	
Early Ohio	No DDT	8.0	16.7	51.0	43.0	29.7	Severe	82
	DDT		0	0	0		None	
Red Warba	No DDT	10.0	10.7	33.7	48.0	25.6	Severe	71
	DDT		0	0	0		None	
Chippewa	No DDT	6.7	8.0	30.0	45.3	22.5	Moderate	107
	DDT		0	0	0		None	
Sequoia	No DDT	3.0	6.7	26.3	39.0	18.7	Mild	11
	DDT		0	0	0		None	
Pawnee	No DDT	4.0	6.0	20.3	39.7	17.5	Moderate	115
	DDT		0	0	0		None	
Mesaba	No DDT	1.3	3.7	17.0	34.3	14.1	Moderate	49
	DDT		0	0	0		None	
Erie	No DDT	2.7	6.7	19.7	20.0	9.7	Mild	6
	DDT		0	0	0		None	
Average	No DDT	9.1	10.7	36.7	45.6	3.7[3]		

[1]Dusting dates: June 18, 21 anl July 3. Heavy rainfall on June 18 and 19 was reason for short interval between applications 1 and 2.

[2]Pre-treatment count.

[3]Difference for significance between undusted at 5 per cent level.

[4]Classified as "none" if less than 5 per cent dead foliage, "mild" if between 6 and 25 per cent, "moderate" if between 26 and 50 and "severe" if over 50 per cent.

TABLE 2—*Leafhopper populations in relation to varieties, hopperburn and yield increases from control with DDT. Planted at Des Plaines on May 23—Average of 3 plots.*

Variety	Treatment[1]	Leafhopper Nymphs per Leaves				Mean	Hopper-burn[2]	Per cent Increase in Yield from DDT
		July 12	July 20	July 26	Aug. 2			
Pontiac	No DDT	81.7	86.0	65.7	26.7	65.0	Severe	179
	DDT	12.3	18.7	0.7	0	7.9	Moderate	
Kasota	No DDT	98.7	94.3	35.7	10.0	59.7	Severe	151
	DDT	7.0	13.7	0	0.3	5.2	Moderate	
Chippewa	No DDT	50.7	73.7	30.7	15.0	46.4	Moderate	159
	DDT	4.3	3.7	0	0	2.0	Mild	
Russet Rural	No DDT	57.0	57.0	35.7	19.0	44.0	Moderate	85
	DDT	4.7	3.0	0	0.3	2.0	Mild	
Katahdin	No DDT	45.3	60.0	38.7	31.0	43.7	Moderate	135
	DDT	7.0	7.3	0	0	3.5	Mild	
Teton	No DDT	63.3	58.3	29.7	18.3	42.4	Moderate	141
	DDT	9.0	7.3	0.3	0.3	4.2	Mild	
Sebago	No DDT	60.3	64.0	26.0	16.3	41.7	Severe	190
	DDT	4.3	10.0	0.3	0	3.7	Moderate	
Pawnee	No DDT	52.3	46.7	33.3	11.3	36.0	Moderate	243
	DDT	8.3	3.0	0	0.3	3.2	Mild	
Sequoia	No DDT	37.3	35.7	33.0	30.0	34.0	Mild	74
	DDT	16.0	2.0	0.3	0.7	4.7	None	
Menominee	No DDT	74.7	34.3	11.7	8.0	32.2	Moderate	113
	DDT	3.3	0.7	0	0	1.0	None	
Ontario	No DDT	50.3	40.3	17.7	13.0	30.3	Moderate	226
	DDT	1.3	0.7	0	0.3	0.6	Mild	
Average	No DDT	61.1	59.1	32.5	18.0	5.2[3]		

[1]Dusting dates: July 8, 22, August 5 and 30.

[2]Classified as "none" if less than 5 per cent dead foliage, "mild" if between 6 and 25 per cent, "moderate" if between 26 and 50 and "severe" if over 50 per cent.

[3]Difference for significance between undusted at 5 per cent level.

with DDT were highly successful at Urbana but not so at Des Plaines. Apparently adult leafhopper infestation and oviposition occurred in the latter planting before DDT was applied. As a result absolute control was never achieved despite thorough applications of DDT.

Leafhoppers, Hopperburn and Yield. There was in general high correlation among leafhopper populations, severity of hopperburn and yield increases from DDT. There were a few varieties, however, in which all three factors appeared to be rather poorly correlated, namely, Early Ohio, Pawnee, Red Warba and Mesaba in the early planting and Russet Rural, Sebago, Pawnee, and Ontario in the later planting. Since Early Ohio, Red Warba and Mesaba are earlier than the other varieties, they may have matured before leafhopper populations were large enough to cause serious yield reductions, as suggested by Sleesman and Bushnell (13). Russet Rural is known to be somewhat resistant to leafhopper injury and this may explain its relative lack of response to leafhopper control. Sebago appeared to be more susceptible to leafhopper injury than some of the other varieties carrying larger populations. Large increases from leafhopper control were obtained from Pawnee and Ontario but they carried only a low to moderate number of nymphs. These two varieties seemed to be highly susceptible to leafhopper feeding although their hopperburn ratings would not suggest this. The remainder of the varieties under the conditions of these tests fell into susceptibility classes as reported by other investigators with Triumph and Pontiac being very susceptible and Sequoia very resistant. Erie had the lowest populations and responded the least to leafhopper control of any variety in the early planting. Although length of season may have been a factor here, these data suggest that under Illinois conditions Erie may have some resistance to leafhoppers.

Length-of-season Increases. Increases in length of season from leafhopper control in the early planting were somewhat greater with the very early varieties than with the later-maturing kinds (table 3). Although it might appear that the prolongation of season for the early varieties was not reflected adequately in yield increases, the length-of-season increases were still less than for the later-maturing varieties. Where early potatoes must be harvested at a predetermined time to be placed on a favorable market, the increases in length of season from DDT indicate that artificial vine killing will be necessary. Revised dates of planting or dates for vine killing for varieties such as Red Warba, Triumph, Mesaba and Cobbler could be determined from these or similar data. Early frost in the later planting (table 4) prevented completion for the most part of length-of-season records.

TABLE 3—*Measurement of the response of* 10 *potato varieties to leafhopper control with DDT. Planted April* 13 *at Urbana—Average of* 3 *plots.*

Variety	Length of Season in Days			No. Tubers per Hill (1 + Inch in Diameter)			Yield in Bushels per Acre			Specific Gravity		Pounds of Starch per Acre		
	No DDT	No DDT	Inc.	No DDT	DDT	Per cent Increase	No DDT	DDT	Per cent Increase	No DDT	DDT	No DDT	DDT	Per cent Increase
Pontiac	110	125	15	4.7	9.0*	91	149	425*	185	1.0390	1.0570	501	2346	369
Triumph	100	120	20	6.1	9.8*	61	158	479*	203	1.0575	1.0655	891	3161	255
Cobbler	105	120	15	7.2	10.5*	46	218	483*	122	1.0676	1.0825	1491	4173	180
Chippewa	110	125	15	7.2	10.4	44	218	451*	107	1.0575	1.0690	1203	3193	165
Pawnee	105	120	15	6.4	9.8*	53	196	421*	115	1.0640	1.0715	1247	3082	147
Early Ohio	95	115	20	5.1	6.2	22	190	345*	82	1.0650	1.0730	1231	2567	108
Red Warba	90	110	20	9.4	10.4	11	244	419*	71	....a	1.0725	....	3117	...
Mesaba	95	110	15	9.0	10.4	15	280	418*	49	1.0695	1.0755	1982	3260	64
Sequoia	140	140	0	10.0	10.6	6	573	637	11	1.0900	1.0990	5432	6727	24
Erie	120	125	5	10.7	11.4	7	522	552	6	1.0770	1.0635b	4134	3511	...
Average	107	121	14	7.6	9.8	36	275	463	95	1.0652	1.0729	2012	3558	164
Difference for significance—odds of 19:1				3.3	1.2		39	70						

* Dusted significantly better than undusted at 5 per cent level.
a Sample lost. This variety not considered in specific gravity and starch per acre averages.
b Early blight infection in dusted plots late in season caused partial defoliation which may have reduced specific gravity.

TABLE 4.—*Measurement of the response of 11 potato varieties to leafhopper control with DDT. Planted May 23 at Des Plaines—Average of 3 plots*

Variety	Length of Season in Days**			No. Tubers per Hill (1 + Inch in Diameter)			Yield in Bushels per Acre			Specific Gravity		Pounds of Starch per Acre		
	No DDT	DDT	Inc.	No DDT	DDT	Per cent Increase	No DDT	DDT	Per cent Increase	No DDT	DDT	No DDT	DDT	Per cent Increase
Pawnee	105	115	10	2.8	4.9*	75	56	193*	243	1.0900	1.0950	531	1945	266
Ontario	120	...	..	2.5	3.7	48	43	139*	226	1.0945	1.1015	431	1518	252
Pontiac	110	120	10	3.3	4.7	42	80	222*	179	1.0870	1.0960	730	2264	210
Teton	120	...	..	4.0	6.4*	60	96	232*	141	1.0915	1.1060	933	2645	183
Chippewa	110	120	10	3.2	6.0*	87	79	205*	159	1.0915	1.0985	768	2163	182
Kasota	115	125	10	4.6	7.4*	61	99	249*	151	1.0895	1.0990	938	2629	180
Katahdin	120	...	..	3.2	4.2	31	102	240*	135	1.1080	1.1115	1187	2382	145
Menominee	...	...	..	4.1	5.3	29	105	223*	113	1.0960	1.1000	1071	2909	122
Russet Rural	120	...	..	3.4	4.3	26	113	210*	85	1.0970	1.1045	1166	2356	102
Sebago	125	...	..	3.5	5.2*	48	70	204*	190	1.1085	1.1160	819	1570	92
Sequoia	...	...	..	3.7	5.0	35	183	319*	74	1.0985	1.0985	1921	3349	74
Average	110	120	10	3.5	5.2	49	93	221	154	1.0956	1.1024	954	2339	164
Differences for significance—odds of 19:1				.7	.9		28	37						

*Dusted significantly better than undusted at 5 per cent level.
**Severe frost prevented completion of records for most varieties.

Tuber Set and Yield. Leafhopper control with DDT resulted in significant yield increases in all varieties (tables 3 and 4) with the exception of Erie and Sequoia at Urbana. Yet only four varieties at Urbana and five at Des Plaines gave significant increases in number of tubers set per hill. Since all tubers regardless of variety are set early in the season probably at very nearly the same time, increases in tuber numbers in these tests may be considered a measure of the growth response of the smaller-size tubers to leafhopper control. Therefore, yield increases in these nine varieties might be attributed to a gain in weight not only in the large but also in the small tubers. All other varieties with the possible exception of Red Warba and Mesaba probably owe yield increases from leafhopper control to weight increases principally in the larger-size tuber classes. Apparently Red Warba and Mesaba set a large number of tubers per hill regardless of extent of leafhopper damage.

Starch Increases. The increase in pounds of starch per acre is considered to be the best criterion for evaluating response to leafhopper control. This takes into account increases not only in yield but also in starch content both of which are functions of leafhopper feeding. Specific gravity increases from leafhopper control with DDT were considerably more uniform at Des Plaines than at Urbana. At Des Plaines above-normal sunshine was accompanied by high starch production. Thus starch-per-acre increases in this planting were perhaps less important in determining differential responses than they were at Urbana. Although Triumph is usually considered more susceptible to leafhopper injury than Pontiac, its total response to control in these tests was somewhat less than Pontiac. The explanation can be found in the specific gravity increase which was 46 per cent (from 1.0390 to 1.0570) for Pontiac and only 14 per cent (from 1.0575 to 1.0655) for Triumph.

From the standpoint of specific gravity and starch per acre, Cobbler among the early to mid-season varieties and Katahdin among the later kinds would appear to have been superior to all others. The performance of Katahdin was all the more remarkable in view of the very low tuber set which would favor high quality but not necessarily high yield.

Diseases. Early blight was not a significant factor in reducing quality and yield except where it developed late in the season in dusted Erie plots at Urbana. Approximately 20 per cent of the foliage on this variety was yellowed which may have accounted to a large extent for failure to obtain significant increases in quality and yield. Early-blight lesions were present only in trace amounts on the other varieties at Urbana and did not appear at all in the Des Plaines planting.

The only virus diseases found in the plots at both locations were mild mosaic and leafroll. Mild mosaic was present only in Pontiac with six per cent infection, a figure considered too low to have markedly influenced yields. Leafroll was detected early in the season in six of the ten varieties at Urbana. Leafroll at Des Plaines could not be diagnosed with any accuracy although it was known that certain of the varieties—the same stocks as those at Urbana—carried the virus.

The potential yields based on freedom from leafroll were calculated for each plot of the six contaminated varieties at Urbana using the equation of Kirkpatrick and Blodgett (8). Average yield increases ranged from 2 bushels per acre for Pontiac (0.8 per cent leafroll) to 15 bushels for Red Warba (11.7 per cent leafroll). This is equivalent to increases of 0.34 and 3.3 per cent, respectively. Other varieties with intermediate increases and leafroll content were Cobbler, Erie, Chippewa and Pawnee. A recalculation of the yield data in table 3 with these corrections showed no significant changes within varieties. However, between varieties, undusted Erie was no longer significantly poorer than Sequoia, and there was no significant difference among Early Ohio, Triumph and Pontiac. Dusted Cobbler became significantly poorer than Erie although it was not poorer before adjustment.

Although yield decreases from leafroll in these tests were relatively small they are so because the leafroll content of the stocks was low. Comparisons based solely on yield among such varieties as Chippewa—very susceptible to leafroll—and Katahdin—moderately resistant—would appear to be misleading unless leafroll content is taken into consideration. Research is needed to determine the per cent infection above which yields in experimental plots need to be corrected for virus diseases. Only in this way can a higher degree of precision in measuring other factors be attained.

Summary

New potato varieties are difficult to evaluate for qualities other than leafhopper resistance if these insects are numerous. Perfect or near-perfect control of leafhoppers is necessary for comparative purposes before the extent of damage from these and other yield-depressing agents can be measured. Phytotoxicity from insecticides and fungicides, and damage from diseases in previous experiments on varietal response to leafhopper control were not subject to measurement or have not been reported. Very little emphasis has been placed in the past on starch content of the tubers in evaluating varieties for leafhopper susceptibility or on length-of-season increases resulting from the use of DDT.

Experiments were undertaken in 1946 to determine the effect of leafhopper control with DDT on length of season, quality and yield of seventeen new and old potato varieties. No fungicides were used. An attempt was made to eliminate or to evaluate other yield-depressing factors. Near-perfect leafhopper control was obtained in an early planting but control in a later planting was somewhat poorer. Previous reports show that leafhopper populations, severity of hopperburn, specific gravity and yield increases from leafhopper control are closely correlated. The present work tends to confirm this. Erie and Sequoia had the lowest populations and responded the least to DDT. Triumph, Pontiac, Pawnee, Sebago and Ontario appeared to be the most susceptible to leafhopper feeding. Length-of-season increases from leafhopper control were greatest in the very early varieties.

Yield increases due to leafhopper control were not always accompanied by corresponding increases in number of tubers set per hill. Increased yields in certain varieties seem to be due to an increase in size of all tubers; others to a gain in weight among larger-size tubers. Red Warba and Mesaba set a large number of tubers regardless of whether leafhoppers were controlled.

Triumph responded more to leafhopper control than Pontiac if measured in bushels per acre but responded less than Pontiac on the basis of starch per acre which takes into account both yield and specific gravity. From the standpoint of starch produced per acre, Cobbler in the early planting and Katahdin in the later planting were superior to all other varieties.

Early blight was not a factor in dusted plots of the Erie variety where reductions were found in both quality and yield. Leafroll was identified in varying amounts in six out of the ten varieties in the early planting. Leafroll content in these stocks was less than 12 per cent with resulting yield decreases of 3.3 per cent or less. The potentialities of virus diseases in experimental potato planting should not be overlooked.

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FERTILIZER AND CULTURAL EXPERIMENTS WITH POTATOES REPORTED DURING 1944-1946

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FERTILIZER EXPERIMENTS

Modern fertilizer experiments with potatoes do not deal only with the yield of tubers. Approaches to the problem vary widely, many studying some aspect of tuber quality.

In the three years, 1944 through 1946, five reports appeared relating soil tests to yield (46, 26, 14, 52, 56). Four dealt with the relation of fertilizers to chemical tests of the petiole or leaf tissue (25, 37, 54, 59). Incidentally, two others dealt with the method of making such tests (21, 44).

Three reports were concerned with the effect of fertilizers on cooking quality (18, 47, 48) and three with the specific gravity of the tubers (17, 34, 54). In Wisconsin the boron in soil and tubers was studied in relation to blackening of cooked potatoes (38). The problem of blackening has also been approached from several other angles (47, 48, 60, 63). Likewise, the studies on the ascorbic acid content of potatoes have been approached from the viewpoint of soil and climate rather than as effects of fertilizer alone (30, 42, 65). This is true also in the question of suitability of potatoes for dehydration (9, 10).

Reports on other of the less common minerals used as fertilizers include a detailed study on the use of sulfate of magnesia potash in New York (54) and a briefer paper from South Carolina (3). The effect of chlorine was reported from Minnesota (36). Colorado studied the effect of minor elements on yield and skin characteristics of Red McClure (39, 55).

Testing new carriers of standard fertilizer elements, Brown and coworkers reported on the value of ammonium nitrate (7) and of colloidal phosphate (8).

Three reports appeared on placement of fertilizers, mostly concerned with the possible advantages of applying part of the fertilizer before plowing or of distributing part on the plow sole (5, 11, 43). Along this line of thinking, Emmert (22) studied the time at which the growing plant critically needs nitrogen and potash nutrients. Ware and Johnson also reported on nitrogen requirement (64).

A report from Idaho summarized ten years of cooperative fertilizer tests (32). The requirements of acidic bracken soil were studied in Eng-

land. (16). In Virginia, Carolus (12) pointed out differences in the effect of fertilizers on yield of tops and of tubers. Wessels briefly summarized the Long Island experiments on soil acidity (67).

Other Soil Conditions

Some results from crop rotations were mentioned in five papers (6, 24, 61, 66, 68). The possibilities of improving soil structure by applications of lignin were explored in New Hampshire (19), and the effect of sawdust reported from Alabama (29). The effects of alkaline salts on the smoothness of skin and the shape of tubers was reported from Idaho (4, 31).

Cultural Treatments

Bulletins on growing the crop were published in Alaska (28), in Indiana (20) and in Missouri (69). Effects of planting conditions on stand and on yield were reported from Louisiana and from California (33, 35). An impressive bulletin on the size of seed piece came from Maine (15). The effect of date of planting and other practices were reported from Rhode Island (51).

Killing of tops by chemicals to facilitate harvesting or aid in control of diseases was studied in North Dakota and in Oregon (27, 45). Some effects of sprout retarding or sprout accelerating treatments were given in three investigations (23, 49, 71).

Studies Concerned with Physiology and Ecology of Growth

Some of the work on the physiology of the plant is of practical interest. Thus, for example, Bald (1) attempted to describe in technical terms the normal growth of potato foliage and later commented on the competition in the growth of tops and tubers (2). Wolf and Duggar (70) studied the physiological role of solanin in the plant; Sukhorukov (58) the role of copper; Street and co-workers the assimilation of ammonium and nitrate nitrogen (57). Cavanillas measured transpiration by means of lysimeters (13).

From an ecological viewpoint, length of day was studied by Rayner (50) and by Montemartini (40). Broad effects of climate were described in three other foreign papers (41, 53, 62).

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RESULTS OF SPRAYING AND DUSTING POTATOES IN NORTH DAKOTA FOR 1946 AND 1947

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Part I. Effect of Insecticides on Tuber Yield

The 1946 plots were at Grafton, North Dakota, and the 1947 plots near Grand Forks, North Dakota. The research was conducted cooperatively by the N.D.A.C. Experiment Station and the State Seed Department. The sixteen treatments were replicated six times, and arranged according to the triple lattice design.

Each of the ninety-six plots was two rows wide and eighty feet long with two untreated buffer rows on each side. The buffer rows permitted the development and build-up of insect populations and received some drift from adjacent insecticidal plots, especially with the dusts. The necessity for buffer rows was particularly shown in the 1946 plots. One-half of certain buffer rows, especially those adjacent to dust plots stood out very green whereas the other one-half of the row showed marked insect damage. Without the separation by buffer rows, the insecticides of low insect toxicity would have demonstrated better insect control than would have been warranted.

The sprays were applied at 400 pounds pressure by a tractor drawn, power take-off Bean sprayer. The dusts were applied by a tractor-mounted Niagara power duster. Applications of insecticides were made between 8:00 p. m. and 4:00 a. m. when there was no drift from wind. The tractor was driven through the check plots at the time of insecticide applications so that any wheel damage would be the same in all plots.

In the 1946 plots, 7 per cent Tribasic Copper Sulphate was added to each dust, with the exception of Velsicol 1068. Tribasic Copper Sulphate was added to each spray material at the rate of 4 pounds per 100 gallons of water. Fungicides were not incorporated with the insecticides in 1947, but all plots received one application of Dithane D-14 following the appearance of early blight, on the 19th of August.

In 1946 both U. S. No. 1 and the total yield data were obtained. The differences between the adjusted means of both yields obtained from the analysis of variance were uniformly constant for all plots.

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TABLE 1.—*Insecticidal treatments and tuber yields*: 1946, *Grafton, North Dakota*

Plot	Treatment	Rates of Application	Dates Applied	Total Yields (Bu. per Acre)
	Sprays Applied at 125 Gal. per Acre	Amount of Insecticide per 100 Gal. Water		
1S	Syndeet 25 per cent DDT emulsion	¼ lb. DDT	July 14, 27 & Aug. 10, 24	131
2S	DDD 25 per cent emulsion	¼ lb. DDT	"	152*
3S	Hexachlorocyclohexane (666) 50 per cent powder	½ lb. 666	"	148
4S	DDT 50 per cent powder	¼ lb. DDT	"	146
5S	DDT 50 per cent powder	½ lb. DDT	"	170**
6S	DDT 25 per cent emulsion	¼ lb. DDT	"	155*
	Dusts	Pounds per Acre		
7D	DDT 5 per cent	35 lbs.	July 13, 27 & Aug. 9, 23	145
8D	DDT 3 per cent	35 lbs.	"	173**
9D	DDT 5 per cent	35 lbs.	July 13, 27 & Aug. 9	157*
10D	DDT 5 per cent	35 lbs.	July 13, 27	144
11D	DDT 5 per cent	35 lbs.	July 13	132
12D	DDT 5 per cent	35 lbs.	July 27 & Aug. 9, 23	153*
13D	DDT 5 per cent	35 lbs.	July 13, 18, 27 & Aug. 3, 9, 16, 23, 30	153*
14D	DDT 5 per cent	35 lbs.	July 13, Aug. 9	151*
15D	Velsicol 1068 5 per cent	35 lbs.	July 13, 27 & Aug. 9, 23	144
16	Check—no treatment			126

*Indicates significant difference at 5 per cent level as compared with Check Plot No. 16.

**Indicates highly significant difference at 1 per cent level as compared with Check Plot No. 16.

Least significant difference between any two adjusted means at the 5 per cent level = 24.86 bu. per acre; at the 1 per cent level = 35.71 bu. per acre.

Insecticides donated by:	Plot Number
United States Rubber Company, New York 20, N. Y.	1S
Rohm and Haas Company, Philadelphia 5. Pennsylvania	2S
E. I. DuPont de Nemours & Company, Wilmington 98, Delaware	3S, 4S, 5S, 6S
Agricultural Supply Company, Grand Forks, North Dakota	7D, 8D, 9D, 10D, 11D, 12D, 13D, 14D
Velsicol Corporation, Chicago, Illinois	15D

TABLE 2.—*Insecticidal treatments and tuber yields*: 1947, *Grand Forks, North Dakota*

Plot	Treatment—July 2, 15, 29 and August 12, 25	Adjusted Mean Yield Bushels per Acre
Dusts: Applied at 20 pounds per acre.		
1D	DDT 5 per cent	259.0
2D	DDT 3 per cent	260.7
3D	DDD 3 per cent	263.4
5D	DDD 3 per cent and HE 761 2 per cent	273.6**
6D	Piperonyl Butoxide 1.25 per cent	254.4
7D	Piperonyl Cyclohexanone .625 per cent	258.6
8D	Benzene Hexachloride (1 per cent gamma isomer)	245.6
9D	Chlordane 5 per cent	260.0
10D	Aryl Alkyl Thionophosphate 1 per cent	258.9
Sprays: Applied at 100 gallons per acre; 1 pound actual lethal ingredient (such as DDT, etc.) per 100 gallons of water.		
4S	Toxaphene (a Chlorinated Camphene)	248.1
11S	DDT 50 per cent Wettable Powder	264.6*
12S	DDT 25 per cent Emulsion	258.6
13S	Hexaethyl Tetraphosphate 9 per cent; other Phosphates 16 per cent	259.2
14S	Benzene Hexachloride 50 per cent Wettable Powder	250.9
15S	Methoxy Chloro Composition 50 per cent Wettable Powder	259.8
16	Check—no treatment	239.9

*Indicates significant difference at 5 per cent level as compared with Check Plot No. 16.

**Indicates highly significant difference at 1 per cent level as compared with Check Plot No. 16.

Least significant difference between any two adjusted means at the 5 per cent level = 24.62 bu. per acre; at the 1 per cent level = 32.74 bu. per acre.

Insecticides donated by:	Plot Number
Agricultural Supply Company, Grand Forks, North Dakota	1D, 2D, 8D
American Cyanamid & Chemical Corporation, New York, N. Y.	10D
California Spray & Chemical Corporation, Richmond, Calif.	13S
Dodge & Olcott Company, New York, N. Y.	6D, 7D
E. I. DuPont de Nemours Company, Wilmington, Delaware	11S, 12S, 14S, 15S
Hercules Powder Company, Wilmington, Delaware	4S
Rohm & Haas Company, Philadelphia, Pennsylvania	3D, 5D
Velsicol Corporation, Chicago, Illinois	9D

Therefore, only the total yields were taken in 1947. The treatments applied and the adjusted mean yields for 1946 and 1947 are listed in tables 1 and 2, respectively.

Results

Two treatments showed significant yield increase when compared with Check Plot No. 16 receiving no treatment. Plot No. 11S (DDT 50 per cent wettable powder) was significant at the 5 per cent level and Plot No. 5D (DDD 3 per cent and HE 761 2 per cent) was highly significant at the 1 per cent level.

The yields for 1947 in general, compared with the results in 1946. DDT 3 per cent dusts again yielded more than DDT 5 per cent dusts although only 1.7 bushels per acre as compared with 28 bushels for 1946.

The combination DDD 3 per cent and HE 761 2 per cent dusts was highly significant at the 1 per cent level and the highest yielding plot. This combination was not available in 1946 when DDD alone gave significant results at the 5 per cent level.

The fluctuations of increased yields cannot be explained by comparable reductions of insect populations. A summary of the insect abundance and tuber yields for the insecticidal plots of 1946 and 1947 will follow in Part II.

Part II. Insect Abundance and Tuber Yield

The results of the 1946 and 1947 North Dakota experiments show that there is no true correlation between insect abundance and tuber yield. The close similarity of actual total yield and the adjusted total yield for the 1946 plots at Grafton and the 1947 plots at Grand Forks indicate a great uniformity of soil and stand. At most, the difference between actual total yield and the adjusted yield was less than two bushels per acre, except for the check plot in 1947. Hence, any differences in yields would be due to insects or the effect of the insecticides on the plants.

In 1938 Munro and Schifino[1] indicated that the increases in tuber yields could not be explained by a comparable reduction of flea beetle injury as determined by an actual count of flea beetle holes in the leaves.

Since there was no true correlation between insect abundance and yields in 1946, it was decided to use the actual damage (leaf holes) of the flea beetle, instead of insects collected by sweeping as a better criterion for correlating damage and yield. Table 3 lists the total insects or damage on the plots for 1946 and 1947, in addition to tuber yield.

In the 1946 plots 12 and 13 yielded alike. Plot 12 had forty-two times as many Colorado potato beetles, four times as many flea beetles

TABLE 3.—*Total insect population and tuber yield*

1946 INSECTICIDAL PLOTS AT GRAFTON, NORTH DAKOTA. (Counts made July 26, August 6, 19 and September 7.)

	Plot Numbers							
	1	2	3	4	5	6	7	8
A	11	24	43	12	22	10	11	12
B	1327	2050	1886	1526	594	1636	1474	2277
C	177	285	374	203	118	223	189	227
D	109	159	199	146	121	135	149	142
Y	131	152*	148	146	170**	155*	145	173**

	Plot Numbers							
	9	10	11	12	13	14	15	16
A	3	7	18	168	4	12	3	205
B	1446	2222	2903	1781	438	2209	2051	3179
C	196	253	269	219	104	210	291	274
D	134	135	115	142	107	131	165	130
Y	157	144	132	153*	153*	151*	144	126

1947 INSECTICIDAL PLOTS AT GRAND FORKS, NORTH DAKOTA. (Counts made July 9, 15, 21, 29; August 5, 12, 20, and September 3.)

	Plot Numbers							
	1	2	3	4	5	6	7	8
A	89	37	177	35	290	302	183	102
B	17514	16243	18511	18914	18183	17748	16769	17234
C	213	192	199	204	244	231	255	352
D	413	393	348	321	275	312	283	364
Y	259.0	260.7	263.4	248.1	273.6**	254.4	258.6	245.6

	Plot Numbers							
	9	10	11	12	13	14	15	16
A	28	304	14	32	192	102	16	437
B	19794	15417	14272	15490	15342	17388	13764	25769
C	307	200	119	110	198	254	126	234
D	414	306	303	252	294	285	208	516
Y	260.0	258.9	264.6*	258.6	259.2	250.9	259.8	239.9

A—Adults and larvae Colorado potato beetle
B—Adult potato flea beetles (1946). Adult potato flea beetle injury (leaf holes) 1947.
C—Adults and nymphs potato leafhoppers
D—Adult six-spotted leafhoppers
Y—Adjusted mean yield bushels per acre
*—Significant at 5 per cent level as compared with Plot 16 receiving no treatment
**—Highly significant at 1 per cent level as compared with Plot 16 receiving no treatment.

and twice as many potato leafhoppers as Plot 13. Plot 12 received only three applications of a 5 per cent DDT dust, whereas plot 13 received eight applications of the same.

Plot 8 receiving four applications of 3 per cent DDT dust was highly significant at the 1 per cent level and the highest yielding plot. However, plot 8 had the third highest population of flea beetles and was above the average for the three other insects. Plot 5 receiving four applications of DDT spray was the only other plot showing high yield significance at the 1 per cent level and had approximately one-quarter the number of flea beetles and half the number of leafhoppers of plot 8.

In the 1947 results, plot 5 (DDD 3 per cent and HE 761 2 per cent) was the fifth highest in flea beetle injury, yet it was the only yield showing high significance. Plot 15 (Methoxy Chloro Composition) with the lowest flea beetle injury and among the lowest in other species of insects did not have a significant yield and was sixth in tuber yield.

In order to account for these differences in yield, further research must be done to determine the possible stimulating or depressing effect caused to plants by the newer insecticides.

Literature Cited

1. Munro, J. A., and Schifino, L. A. 1938. Potato spraying experiments in North Dakota. Jour. Econ. Ent. 31 (4): 485-487.

REPORT OF FIELD MEETING — POTATO ASSOCIATION OF AMERICA

Aroostook Farm, Presque Isle, Maine

August 19 - 20, 1948

The meeting was called to order by Verne Beverly, County Agricultural Agent, who introduced Dr. Fred Griffee. Mr. Beverly was instrumental in making all the preliminary arrangements. Dr. Griffee extended greetings for the members of the Experiment Station staff who were present at the time. There were about 60 people from the United States and Canada. Later, this number was increased to 80.

A mimeographed sheet was furnished to each one present, giving in detail something about the potato research work that was being carried on at the farm. In addition, to this material, copies of the program and a circular regarding the new potato house were made available.

President Newdick outlined the purpose of the conference, indicating (1) that it was to be a serious meeting; (2) that there would be

no opportunity for play; and (3) the value of the meeting would depend upon the individual, because a selection would have to be made to get that which one desires most.

At 10 A. M. the group visited the fields, and, under the guidance of Dr. Bonde not only visited the aphid control experiments, but also some virus-disease work by Dr. Schultz as well as some fertilizer and organic experiments by Dr. Terman.

After lunch the field studies were resumed. Dr. Folsom then gave an outline of the work in which temperature controlled bins had been used. The result of storage on net necrosis and stem-end browning was explained.

Following this a demonstration on the use of the flame thrower for killing tops was held. The disease service plots were then visited and symptoms of some of the virus diseases explained in detail. This was particularly for the benefit of many of the certified officials and inspectors. We next moved to the ring-rot plot below the track and at this point Dr. Bonde discussed his work with resistant varieties.

The day's program was rounded out by Mr. Lombard who showed us some of his most recent work in row and tuber-spacing occasioned by the introduction of the Kennebec variety.

Robert Akeley, of the U.S.D.A., showed us some very promising seedlings and dug some tubers so that a study could be made. This completed the field work for that day.

In the evening a banquet was held at the Northeastland Hotel, with President Newdick presiding. Although the evening was very warm, it was a most enjoyable one for the 110 members and guests who were present. As usual, all the visiting officials of the Association were introduced. The main address of the evening was given by A. K. Gardner, Commissioner of Agriculture of the State of Maine. This was followed by the presentation of a colored film entitled "As Maine Grows". The picture was shown by Mr. Bryce Jordan, Manager of the Seed Department of the Maine Potato Growers, Inc. The making of this picture was financed by this organization and they deserve a lot of credit for making available to the Industry what, to me, is the best picture I have ever seen showing the production of certified seed. Enough talent was available for an extended program but on account of the strenuous day and the rather warm evening, it was decided to adjourn early.

Friday morning, August 20th, the group gathered again at Aroostook Farm. Pilot Soucy, who was flying over in a helicopter, yielded

to our signals and landed for a short stop to explain something about his experiment. All were grateful to him for his "flying visit."

Dr. Stevenson and Mr. Akeley took some of the visitors to the Chapman Farm where several acres of extensive breeding work are being conducted. The writer did not attend this session. Those who did attend praised it highly. Many of them also visited the spraying work on the Kempton Farm.

Those interested in diseases, and who remained at Aroostook Farm, spent some time in the greenhouse where Drs. Schultz, Bonde and Dr. MacLeod gave a clear-cut explanation of purple top, particularly stressing symptoms and results.

At this point we again visited the disease plots. A field discussion period was held regarding black leg, after which the meeting resolved itself into a question and answer period. Before departing we visited the top-killing plot with a talk by Paul Eastman of the station staff.

At 12:30 it was decided to adjourn officially and permit each individual to select his own program for the afternoon. Many returned to the Station for further discussion with the staff members regarding specific problems. A small group was accompanied on a tour around the country.

In conclusion, let me say that all of us are very grateful to Mr. Keenan and Mr. Scannel of the Dominion Department of Agriculture at Ottawa for the results of their efforts in attracting such a fine attendance at the meeting. There were 45 members present from the various Provinces. I sincerely hope they felt their time was well spent. Your President was very frank in telling every one that if he failed to get information from the Aroostook Farm meetings it was his own fault.

Respectfully submitted,

E. L. NEWDICK, *President.*
Potato Association of America.

SECTIONAL NOTES

INDIANA

Our commercial potato harvest has started in full swing. We have ideal weather for getting the potatoes out of the ground and the yield and quality are exceptionally good this year. We will have quite a few growers who will exceed more than 400 bushels of No. 1's to the acre,

not overly large, and a still higher percentage of No. 1's than we have ever had before.

Our growers kept spraying and dusting to control the diseases and insects and find that these late control measures are the most profitable ones to apply. The potatoes are moving to the market in 10 and 25-pound sacks and the consumers are well satisfied with these family-size packages. The Indiana potatoes in our state are out-selling all other sources four to one.—W. B. WARD.

NEBRASKA

Notes from Nebraska have been neglected for some time, so a little in recapitulation should be in order. Growers, remembering rainy periods in mid-June in previous years, began planting about the 1st of June, two weeks earlier than usual. The rainy period from the 15th to the 25th of June then held up planting until the latter part of the month. Nebraska growers, therefore, have an early and a late-planted main crop.

The early plantings grew rapidly through a cool July and early August. About the 10th of August there was a sudden change. Whereas, temperatures had been below normal, the other extreme became the rule, with day after day temperatures in the high 90's or over 100°.

The result on the dry land crop has been to fire severely or to mature the plants. In many fields, because of the early growth, there was already a good set, and possibly an average yield had almost materialized. During the same time, the growers who used irrigation, had difficulty holding their crops because of this heat, which caused excessive evaporation. It is difficult at this time to evaluate the result of these extremes on the crop, though it is apparent that a better crop is in prospect than was the case in 1947 when we had a short crop.

The first general rain in almost a month is falling at this time. What the outcome may be is problematical. We think that the early fields will not be revived. Some other fields, however, may resume growth, resulting in poor type. Early Blight infection, which usually occurs about this time of the year, may be suddenly built up and become a serious factor, providing the rains are followed by fog and high humidity for a few days.

The early crop in central and eastern Nebraska is practically cleaned up at this time. This crop, which started off with a number of difficulties in the spring, was favored by the good conditions in midsummer, and excellent yields were the general rule. Many fields of Red Warba potatoes yielded 300 sacks of No. 1 grade. In general, the prices were at or above support levels. In the past two or three weeks

this has sagged somewhat, and the Government has been purchasing many of the potatoes being harvested.

At this time, the interest in the Government support is still not too strong. Last year there was practically no sign-up in the late crop. However, the indications are that many more growers are taking advantage of the program offered by the Government this season.

The Government, in cooperation with the State College of Agriculture and local interests, ran an interesting experiment about a month ago on the potatoes harvested in central Nebraska. Some of the surplus purchased by the Government was sliced up and spread on the runways of an air strip for natural dehydration. The product that resulted is being tested in feeding experiments at the University of Nebraska this fall and winter. Members of both the potato and cattle industry are watching this with interest.

The acreage of potatoes entered for certification in Nebraska is approximately 20 per cent less than in 1947. This is a continuation of the trend established three years ago; to a lesser degree this reduction in acreage is also true of commercial or non-certified plantings.

The reasons for the reduction in acreage planted to potatoes is first the competition offered by other crops that are much more easily grown. The crop which is most favorable under dry land conditions is winter wheat, which can be grown with a minimum of labor, and which, of course, has been producing high yields at high prices. Under irrigated conditions the crop which is replacing potatoes is largely beans of the dry, edible type. The ease of growing and harvesting in the case of beans, in addition to the extremely high prices, has made it a strong competitor of potatoes.

In addition to the crop competition, we have had a disparity of prices for the past year or two. Certified seed growers have not received the high premiums that existed for many years and during the past year many certified seed potatoes were diverted to table stock channels. This was caused by the fact that table stock out of this territory sold on the market at extremely high prices. In previous years the competition of certified potatoes was from certified seed in other states, but during the past season especially, this competition was primarily local-grown table stock.—MARX KOEHNKE.

NEW YORK

Growers who took care of their crop will harvest their biggest yield in years. Cobblers and Chippewas now being dug are reported at 500 bushels and more per acre. However, in poorly-cared-for fields

blight is taking its toll and this will reduce the average for the state but it still will probably be the highest on record.

The certified seed crop is showing fine promise. Disease counts have been low and insects have been well controlled. A campaign for close planting to keep size down has been a big help this year in keeping the tubers within seed size tolerance.

Markets are more or less demoralized. Many growers under the Support Program will utilize its facilities, but the general market is about 25 cents under support. Potatoes from out of state form one of the chief competitive factors.

Many of our growers are using a 2¼" and some 2½" screen to insure more uniform sized packages. Seed growers, especially, will use these screens to take off the larger sizes for market, saving the smaller sizes for certified seed. This size, coupled with high quality and an apparent desire to give the public better potatoes, ought to help move the crop to local markets.

The potato vines show vigorous growth but the set is not in keeping in many fields. Many growers consider the government estimate of yield too high. Our growers may still have to contend with dry or wet weather, frost and blight.

Fields under certification are showing a remarkable freedom from virus diseases, reflecting their program to develop the best Foundation stock. Our growers have planted their potatoes closer in order to keep the size down.—H. J. EVANS.

OREGON

The use of improved seed is having its effect in reducing the disease content of the Klamath potato crop. Our second field inspection was completed with a much higher percentage of the crop entered meeting certification requirements. It was particularly noticeable that much seed of local origin which was planted this year met certification requirements. This is a particularly healthy development.

A meeting of potato growers is scheduled for the 1st of September in order that all growers from this entire district might consider regulations to be put into effect under the Potato Marketing Agreement. Organization of an area committee was completed about two months ago. Approximately 85 to 90 per cent of the potatoes in the area are eligible for potato support.

In general, the crop is very promising and with frost-free weather continuing, improved yields and quality should result. The acreage, however, is only slightly above that of last year.—C. A. HENDERSON.

Vermont

The 1948 acreage of potatoes in Vermont is well down to an all time low, approximately 7,000. During the time, however, that a great many farmers have dropped out of potatoes entirely, there has been a marked development in specialized potato growing. Acreages varying from 50 to 100 are fairly common among commercial growers and most of these growers have not only good storage houses but also up-to-date equipment.

All indications point to a good yield. Some late blight started in mid-August, but the extremely hot spell late in the month apparently dried it up. Little early blight and no ring rot had been reported to date. Black leg was rather common, and the virus diseases appeared to be slight.

Only 457 acres were entered for certification, most of which has passed field inspection. Our varietal break-down is as follows: Green Mountains, 221 2/3; Katahdins, 182¼; Houmas, 50; Russets, 1/5; and Others 3.

Top-burning was effectively demonstrated at the Fred W. Peaslee farm in Guildhall on the last day of August when the Seed Potato Growers' Association held its annual meeting there. Several growers are using this means of solving the heavy vine problem during their harvesting operations.

Insects, with some exception regarding aphids, have become practically *nil* in the potato fields of Vermont with the advent of DDT. It is now nearly 100 per cent in general use.—Harold L. Bailey.

Manitoba

During the past 15 days our growing conditions have been ideal. Manitoba is expecting one of its greatest vegetable crops in the last 15 years. The market is being glutted practically for every variety of vegetable.

The potatoes in certain sections of the province are heavily infested with late blight and due to the lateness of the season the growers are not able to control this spread and at present it appears that the crop will be lower by at least 50 per cent due to the infestation of the disease.

The seed potatoes are doing wonderfully well and the seed growers seem to be more successful in controlling late blight.

We are anticipating a heavy yield especially of the Cobbler and Green Mountain varieties.—H. Wasylyk.

Province of Ontario

Continued hot, dry weather in many sections of the Province has interferred with the development of the late potato crop, resulting in lower yields than was anticipated a few weeks ago. The quantity of marketable tubers as Canada No. 1 grade will be further reduced in some areas by scab and blight diseases. The maturity is reported as satisfactory and the cooking quality better than normal.

Several growers have rushed digging in order to seed their fields to winter wheat or rye, thus taking advantage of the period between grain harvesting and other fall work to market a percentage of their potato crops before any loss from disease, These factors account for the large amounts of potatoes reaching the markets. From the buyers' angle, demands have not been too brisk, due to some reduction in consumption because of hot weather, the holiday season, and the fact that it is yet too early to buy for winter storage. The general opinion is expressed that market prices for high quality potatoes will substantially improve as the season progresses.

Trading is reported as steady on Toronto Market (Sept. 9) with wholesale prices to retail trade for Canada No. 1 grade potatoes at $1.35 to $1.40 per 75 pound bag. Consumer demands favor a premium for pre-packaged and basket quantities.

More than 300 potato growers are members of seventeen 500-bushel per acre clubs this year, organized by county and district branches of the Ontario Crop Improvement Association. Yield lists will be estimated and quality scores made during the next few weeks. There is much interest in these contests.

The survey for bacterial ring rot disease is underway as a free service to potato growers. Only a few cases have been located to date, and these have been trace infections.

Several inquiries from export buyers have already been received for seed.—R. E. Goodin.

Ottawa Section Canada

The first field inspection of potatoes in Canada for certification purposes was completed approximately by the 1st of August. All districts report that a high percentage of fields passed this inspection. Apparently there has been a very low percentage of disease this year, and insects are also very scarce.

At the time of writing our second inspection is drawing to a close. and most areas still report a high percentage of fields passing as Foundation and Foundation A stock. Late blight is present is most areas,

but so far where fields have been sprayed and dusted it has not reached serious proportions.

The indications are that there will be a good yield, and in some parts of New Brunswick top-killing operations have been carried out to prevent the tubers from becoming too large.—J. W. SCANNELL.

ANNUAL MEETING, POTATO ASSOCIATION OF AMERICA DECEMBER 6-7-8. PITTSBURGH, PENNSYLVANIA

The annual meeting of the Potato Association of America will be held in Pittsburg December 6-7-8. We will hold a joint meeting with the American Phytopathological Society, Wednesday afternoon, December 8.

We want to make this an outstanding meeting since it will be our 25th anniversary. We need approximately fifty papers on all phases of the potato industry, in order to prepare an outstanding program. All persons desiring to present a paper at these meetings should submit titles and abstracts to John C. Campbell, N. J. Agricultural Experiment Station, New Brunswick, New Jersey, not later than November 1. Those desiring to present papers at the joint meeting with Phytopath must submit titles by October 20.

HEADQUARTERS FOR ANNUAL MEETING

The Fort Pitt Hotel has been chosen as the headquarters for the annual meeting of the Potato Association of America. Rates will be $3.75 to $5.00, single room, with bath; $5.50 to $7.00 double bed, with bath; and $7.00 to $8.00 twin beds, with bath.

Secure room reservations *now* by writing directly to the hotel.

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